SOLUTION

f has only one x-intercept and we can use the graph of f in Figure 2.54 to show that it is about -0.26. The y-intercept is $f(0) = -1$. The vertical asymptote is $x = 1$ as we have seen. We know that the graph of f does not have a horizontal asymptote, and from Example 7 we know that the end-behavior asymptote is $y = x^2 - 2x + 1$. We can also use Figure 2.54 to show that f has a local minimum of 3 at $x = 2$. Figure 2.54 supports this information and allows us to conclude that

$$\lim_{x\to 1^-} f(x) = -\infty \text{ and } \lim_{x\to 1^+} f(x) = \infty.$$

Domain: All $x \neq 1$
Range: All reals
Continuity: All $x \neq 1$
Decreasing on $(-\infty, 1)$ and $(1, 2]$; increasing on $[2, \infty)$
Not symmetric
Unbounded
Local minimum of 3 at $x = 2$
No horizontal asymptotes; end-behavior asymptote: $y = x^2 - 2x + 1$
Vertical asymptote: $x = 1$
End behavior: $\lim_{x\to -\infty} f(x) = \lim_{x\to\infty} f(x) = \infty$

Now try Exercise 51.

Exploring Relative Humidity

The phrase *relative humidity* is familiar from everyday weather reports. Relative **humidity** is the ratio of constant vapor pressure to saturated vapor pressure. So, relative humidity is inversely proportional to saturated vapor pressure.

CHAPTER OPENER PROBLEM (from page 169)

PROBLEM: Determine the relative humidity values that correspond to the saturated vapor pressures of 12, 24, 36, 48, and 60 millibars, at a constant vapor pressure of 12 millibars. (In practice, saturated vapor pressure increases as the temperature increases.)

SOLUTION: Relative humidity (RH) is found by dividing constant vapor pressure (CVP) by saturated vapor pressure (SVP). So, for example, for SVP = 24 millibars and CVP = 12 millibars, RH = 12/24 = 1/2 = 0.5 = 50%. See the table below, which is based on CVP = 12 millibars with increasing temperature.

SVP (millibars)	RH (%)
12	100
24	50
36	$33.\overline{3}$
48	25
60	20

QUICK REVIEW 2.6 *(For help, go to Section 2.4.)*

In Exercises 1–6, use factoring to find the real zeros of the function.

1. $f(x) = 2x^2 + 5x - 3$
2. $f(x) = 3x^2 - 2x - 8$
3. $g(x) = x^2 - 4$
4. $g(x) = x^2 - 1$
5. $h(x) = x^3 - 1$
6. $h(x) = x^2 + 1$

In Exercises 7–10, find the quotient and remainder when $f(x)$ is divided by $d(x)$.

7. $f(x) = 2x + 1, d(x) = x - 3$
8. $f(x) = 4x + 3, d(x) = 2x - 1$
9. $f(x) = 3x - 5, d(x) = x$
10. $f(x) = 5x - 1, d(x) = 2x$

SECTION 2.6 EXERCISES

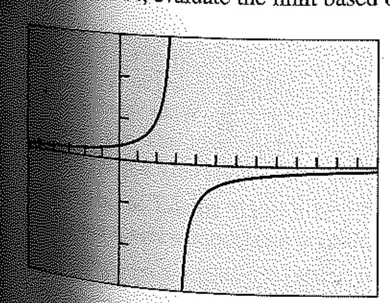
In Exercises 1–4, find the domain of the function f. Use limits to describe the behavior of f at value(s) of x not in its domain.

1. $f(x) = \dfrac{1}{x+3}$
2. $f(x) = \dfrac{-3}{x-1}$
3. $f(x) = \dfrac{-1}{x^2-4}$
4. $f(x) = \dfrac{2}{x^2-1}$

In Exercises 5–10, describe how the graph of the given function can be obtained by transforming the graph of the reciprocal function $g(x) = 1/x$. Identify the horizontal and vertical asymptotes and use limits to describe the corresponding behavior. Sketch the graph of the function.

5. $f(x) = \dfrac{1}{x-3}$
6. $f(x) = -\dfrac{2}{x+5}$
7. $f(x) = \dfrac{2x-1}{x+3}$
8. $f(x) = \dfrac{3x-2}{x-1}$
9. $f(x) = \dfrac{5-2x}{x+4}$
10. $f(x) = \dfrac{4-3x}{x-5}$

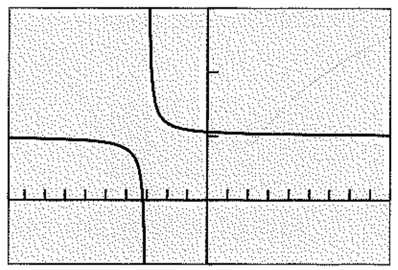
In Exercises 11–14, evaluate the limit based on the graph of f shown.



[–5.8, 13] by [–3, 3]

11. $\lim_{x\to 3^-} f(x)$
12. $\lim_{x\to 3^+} f(x)$
13. $\lim_{x\to\infty} f(x)$
14. $\lim_{x\to -\infty} f(x)$

In Exercises 15–18, evaluate the limit based on the graph of f shown.



[–9.8, 9] by [–5, 15]

15. $\lim_{x\to -3^+} f(x)$
16. $\lim_{x\to -3^-} f(x)$
17. $\lim_{x\to -\infty} f(x)$
18. $\lim_{x\to\infty} f(x)$

In Exercises 19–22, find the horizontal and vertical asymptotes of $f(x)$. Use limits to describe the corresponding behavior.

19. $f(x) = \dfrac{2x^2-1}{x^2+3}$
20. $f(x) = \dfrac{3x^2}{x^2+1}$
21. $f(x) = \dfrac{2x+1}{x^2-x}$
22. $f(x) = \dfrac{x-3}{x^2+3x}$

In Exercises 23–30, find the asymptotes and intercepts of the function, and graph the function.

23. $g(x) = \dfrac{x-2}{x^2-2x-3}$
24. $g(x) = \dfrac{x+2}{x^2+2x-3}$
25. $h(x) = \dfrac{2}{x^3-x}$
26. $h(x) = \dfrac{3}{x^3-4x}$
27. $f(x) = \dfrac{2x^2+x-2}{x^2-1}$
28. $g(x) = \dfrac{-3x^2+x+12}{x^2-4}$